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DEVELOPMENT OF AN INTERNATIONAL AIRPORT

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DEVELOPMENT OF AN INTERNATIONAL AIRPORT

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Today I would like to discuss with you some of the engineering problems encountered in the development of an International Airport.

Before beginning, however, I want to make it perfectly clear that it is not my intention to infer that each and every airport will be confronted with the same problems or that each can be developed by a predetermined pattern that would be equally applicable to all situations. The development of each airport, like all other engineering jobs, will have its own peculiar problems and the solution of these problems cannot necessarily be applied to all other airports. Nevertheless, a wider knowledge of these problems, together with their solution, will foster the acceptance of a designed procedure that will be flexible enough to permit the development of an airport in systematic increments so that the fundamental purposes of the development program can be economically achieved and the proper interrelationship between the airport and surrounding community maintained.

Perhaps the first step in the analysis of any particular airport development program will be a determination of the scope of the functions to be performed by the completed project. That is to say, what types of airfield activities are anticipated and to what extent are satellite functions to be developed either complementing the airfield activities or as auxiliary revenue producers to help finance the development.

Today I would like to confine my observations to the problems encountered in the development of a large International Airport. I realize that there are engineering problems associated with lesser airports that may not appear in this category. However, they are to a large extent a subject unto themselves and, I believe, should be treated separately.

It is no longer feasible to design the all-purpose airport where high density air traffic is anticipated in the future. Such a project would of necessity penalize and discourage all phases of aeronautical activity and could not adequately provide for the heterogeneous traffic encountered.

It is apparent that before the actual design of an International Airport can be started that it will be necessary to initiate comprehensive studies of the air transportation market and to estimate the potential air traffic that may normally be expected so that the size and complexity of the installation can be determined. These air traffic studies should include forecasts sufficiently distant into the future to determine air installation criteria that will not become inadequate or obsolete during the life of the development bond issue. Cognizance of not only the air transportation market, but also the trends in other forms of public transportation will be a prerequisite to the air traffic study. Air traffic forecasts in the past have been, without exception, far below the actual volume of air traffic subsequently encountered. While many factors undoubtedly contributed to this unanticipated accelerated growth of

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air transportation, it is by now apparent that the Engineer failed to realize the full impact that dependable and economical air transportation would have on the travelling public. The airlines, just as the railroads in their early days, generated a transportation market where none existed before in that the reduction in travel time made many trips feasible that heretofore would not have been considered. A comprehensive air traffic study is now faced with a newcomer in the air traffic market, the "Short Haul Passenger", and unless adequate allowances are made for him, the development and acceptance of helicopter service will generate an unexpected volume of air passengers at large airports for whom no facilities have been provided.

The number of air passengers and the volume of air cargo alone will not furnish sufficient data for planning a large airport. The advancement in aircraft design must be taken into consideration because as the capacity of future aircraft increases there will be a corresponding decrease in plane movements for a given number of passengers. As the air transportation market grows there will be a saturation of schedules between large communities that can only be offset with larger aircraft. We have already seen commercial air transports capable of handling approximately 90 passengers and it is not improbable that large aircraft ten years hence will have 120 or more passenger capacities. In addition to these larger aircraft, there are indications that passenger load factor will remain substantially higher than has previously been accepted as normal. For these reasons the total number of plane movements at a given airport will not be as great as the passenger traffic may indicate using existing aircraft criteria. These larger aircraft will, however, require airfield facilities far superior in size and capacity than those now generally in use, and in order to avoid allocating money for facilities that will not be required for some years in the future, prudent airfield design will dictate that new facilities must be constructed from plans that are easily susceptible to future expansion and alterations in order to meet changing operational requirements.

When attempting to correlate the air traffic study with the design of future facilities it will be apparent that the peak hour air traffic, rather than the average annual air traffic, will be the major factor limiting the growth of the airport. Since it is only logical that we should anticipate schedule saturation in the future scheduled diversions cannot be used as an expedient for extending the capacity of the airport as has been sometimes done in the past. The peak hour capacity of the airport should be determined with the knowledge that, although considerable progress has been made toward the perfection of the electronic navigational aids and air traffic control procedures within the last decade, a runway can still safely handle no more than 40 landings and takeoffs per hour during bad weather conditions when all air traffic must be controlled. For planning purposes it should be considered doubtful that this number of operations can be obtained under all conditions of mixed traffic and that more probably this number of operations represents an obtainable maximum. During Visual Flight Rules weather the runway acceptance rate may approach 60 operations an hour, and if two parallel runways are provided, the airport capacity could be increased to 120 operations during a peak hour. This additional runway will not appreciably increase the acceptance rate of the airport during Instrument Flight Rules weather, and should the airport be located in a region where Instrument Flight Rules weather conditions prevail over extended periods, it would be foolhardy to estimate the airport capacity on the basis of the acceptance rate of dual runways. It is probable that future navigational and landing aids will permit the operation of parallel runways

during Instrument Flight Rules weather. However, there are no indications that this will come about within the foreseeable future.

The Master Plan of a large International Airport should anticipate eventual air traffic saturation and should suggest an area plan for the future development of airports within the immediate vicinity. The plan should be comprehensive enough to provide facilities for the private aircraft owner and to foresee the use of jet propelled commercial aircraft as well as the acceptance of helicopter taxi service. At the same time the overall plan should be fluid enough so that each factor may be adjusted to its relative importance as time goes by. The area plan must not only be concerned with air navigation space and traffic patterns, but also the inter-relationship of the airport to the surrounding community. It is only normal to expect that the communities will grow and eventually infringe on or encompass the boundaries of the airports and therefore, insofar as weather conditions will permit, runways and approach zones should be oriented to take advantage of surrounding areas that are not susceptible to extensive developments.

As the development of the community begins to encompass the airport the problem of controlling the noise emanating from operating aircraft will become more acute. Communities are already complaining of the noises generated by large reciprocating aircraft engines and as the frequency of arriving and departing aircraft increases, together with the eventual introduction of jet propelled aircraft into the transportation field, this problem may become so aggravated that the existence of the airport will be jeopardized. The seriousness of the problem can be appreciated when it is realized that the vast majority of the complaints today originate from the operation of reciprocating aircraft with sound intensities in the neighborhood of 100 decibels while the turbo-jet engine equipped with an after-burner may produce sound intensities approaching 140 decibels. These intensities are well above acceptable sound levels and, therefore, every effort should be made to reduce ground run-up noises by including in the Master Plan any acoustical treatment that may be afforded by the proper arrangement of trees, shrubbery and turf. Approach zones and traffic patterns should be arranged so that aircraft will not be required to fly over densely populated areas. It is ridiculous to conclude that a satisfactory solution to the noise problem could be obtained by the simple expedient of relocating airports or placing time limitations or restrictions on their use. Such a solution would not only be detrimental to the entire air transportation industry, but would also destroy progress that has been made towards expediting the passengers between the airport and the community.

Terminal site planning should be undertaken simultaneously with the airfield planning. Various air passenger and terminal visitors surveys should be made in order to determine criteria for planning the future terminal site. These studies should be comprehensive enough to aid in the forecasting of future terminal visitors, the amount of concession business that may be expected, the vehicular traffic in the terminal area, and the amount of baggage and cargo to be handled through the terminal. Provision should be made in the terminal design so that future expansion is possible and that various relative facilities may be added as needed. All utilities serving the terminal area should be planned with future requirements in mind, even though it is probable that they will be constructed in stages. Since it is entirely probable that the terminal site will first be developed in a scattered area, it is also important to plan the units so that a large capital outlay will not be required for each additional facility, thereby discouraging small projects that would otherwise be self-amortizing.

In order for the travelling public to derive the maximum benefits afforded by air transportation it will be necessary for the Master Plan to include a vehicular traffic study on the approach to the airport. Every effort should be made to make the airport more accessible to the center of the population so that the time consumed travelling to the airport will be reduced sufficiently to make short-haul air trips feasible. If an express highway is provided for this purpose it is possible that it would not only appeal to airport customers but to all cross-town traffic as well, and may therefore easily be amortized during its life.

After the completion of the Master Plan and prior to initiating the construction program, the engineer will probably be called upon to make an economic survey of the existing and proposed air facilities. This survey will undoubtedly be used to substantiate the validity of a bond issue of sufficient magnitude to finance the proposed improvements. In many cases it will be found that the revenue derived from the completed project will not be sufficient to repay the bond issue and that additional money derived from taxation will be required. Even so, it will be to the advantage of all concerned, and the duty of the engineer to recommend as many satellite revenue producers as can be justified on the airport. Discretion should be exercised in choosing these additional tenants so that the airport is not placed in a position of competing with private business in the community and thereby gain the enmity of its citizens.

The International Airport will have to provide facilities in the terminal area for such government agencies as public health, immigration and customs. Since these facilities are non-revenue producers, it will be necessary that the gross income derived from the operation of the terminal will be great enough to offset this loss in revenue. These facilities may in some cases function in conjunction with the neighboring seaport and will consequently require little terminal space. However, cases have occurred where the seaport facilities are subordinate to those at the airport and thereby aggravating the loss in net terminal revenue. It is, therefore, imperative that the functions of these agencies be concisely determined prior to initiating the terminal area design.

The international air terminal will always be confronted with the language problem and provision should be made in the terminal design for a centrally located "international center" where foreign travelers may acquire information and assistance in accordance with their particular needs. In many cases the international passenger will not be terminating his journey at his point of entry and may have insufficient lay-over time to visit the surrounding community so that he may be in the market for all manner of additional services that can be supplied at the air terminal.

In closing, let me emphasize that while the Master Plan is chiefly concerned with the movement of aircraft and the development of the physical features of the airport, it is imperative that the air passenger should be ever present in the engineer's mind. In the final analysis he is the one who makes the whole project possible and for whom the facilities are intended. He will require more consideration that has been afforded him in the past and as air transportation grows, he will come to accept conveniences as common place that once were luxuries. He has become accustomed to the easily accessible railroad and bus station that either provides or is adjacent to the necessities he may require while on his trip. These things he takes for granted and will, therefore, be reticent to accept less from air transportation.

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The technical papers published in the past twelve months are presented below. Technical-division sponsorship is indicated by an abbreviation at the end of each Separate Number, the symbols referring to: Air Transport (AT), City Planning (CP), Construction (CO), Engineering Mechanics (EM), Highway (HW), Hydraulics (HY), Irrigation and Drainage (IR), Power (PO), Sanitary Engineering (SA), Soil Mechanics and Foundations (SM), Structural (ST), Surveying and Mapping (SU), and Waterways (WW) divisions. For titles and order coupons, refer to the appropriate issue of "Civil Engineering" or write for a cumulative price list.

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- a. Beginning with "Proceedings-Separate No. 200," published in July, 1953, the papers were printed by the photo-offset method.
- b. Presented at the Miami Beach (Fla.) Convention of the Society in June, 1953.
- c. Presented at the New York (N.Y.) Convention of the Society in October, 1953.
- d. Beginning with "Proceedings-Separate No. 290," published in October, 1953, an automatic distribution of papers was inaugurated, as outlined in "Civil Engineering," June, 1953, page 66.
- e. Discussion of several papers, grouped by divisions.
- f. Presented at the Atlanta (Ga.) Convention of the Society in February, 1954.

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